Silicon and Potassium to Improve Cold Hardiness in Citrus Production in North Florida

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Take Home Message:

- Silicon alone or in combination is effective in improving the cold hardiness in satsuma mandarin and red navel orange.
- Silicon centration 150 ppm is the safe level for use in citrus production systems, but more research is needed to refine the application rate specie-wise.
- Silicon is an ecofriendly and economical substance to add in the citrus nutrition program.

Summary: Winter freeze is the main threat to the emerging citrus industry in North Florida, South Georgia, and Southeast Alabama. Growers use microsprinkler irrigation as a freeze protection strategy to protect the graft union of young trees; it is not very effective in protecting above ground plant parts in established trees. Use of stress mitigating substances could be an effective approach to improve a plant's tolerance to freezing. Potassium (K^+) is one of stress mitigating substances involved in the many stresses associated metabolic pathways and its tangible applications can enhance the plant ability to cope with the stresses. High concentrations of K^+ protect against freezing by lowering the freezing point of the plant's cell solutions. Furthermore, adapted cytosol K^+ concentration is also essential for enzyme activities that are involved in frost resistance. Silicon (Si) is also an important micronutrient that can protect plants from freeze damage by modification of the cell wall and prevent membranes damage. Si can also enhance the stability of cuticle on the leaves and help plants in protecting against heat and cold stress. In the current study, we have examined the role of exogenous applications of Si (50 ppm + 100 ppm) and K^+ (50 ppm + 100 ppm) on 'Owari' satsuma under different freezing temperatures from 0 to -10 °C in a programmed freezing chamber and on-farm trials under field conditions. Overall, the Si alone and in combination with K^+ enhanced the freezing tolerance. Field trials are ongoing to determine the best Si application rate and application frequency for getting the optimum cold hardiness in satsuma mandarin and red navel orange.

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